Determinants of Ins and Outs of Unemployment

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June 29, 2019

Abstract

We estimate the robust determinants of the inflow rate into and outflow rate from unemployment in a sample of OECD countries, using Bayesian model averaging approach to overcome model uncertainty. We find that the main determinant of outflows from unemployment is expenditure on passive labour market policies, while the main determinant of inflows into the unemployment is the duration of benefit entitlement.

JEL Classification Numbers: E24; J6; J2.

Keywords: Unemployment inflow; Unemployment outflow; Bayesian model averaging; Labour market institutions

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1 Introduction

Unemployment remains one of the key economic challenges. One of the recent approaches to understand the causes of unemployment is to study its dynamics over time, distinguishing between the inflows into and outflows from unemployment. These flow rates reflect the probabilities that an employed worker becomes unemployed and that an unemployed worker finds a job. The dynamics of unemployment, its ins and outs, has been studied for the U.S. (Fujita and Ramey (2009); Yashiv (2007); Shimer (2012)), OECD countries (Elsby, Hobijn, and Şahin, 2013), UK (Smith (2011); Gomes (2012)), France (Hairault, Le Barbanchon, and Sopraseuth, 2015), Germany (Rahn and Weber, 2017), Japan (Lin and Miyamoto, 2012), New Zealand (Razzak, 2016) and Europe (Petrongolo and Pissarides, 2008). However, little is known about the driving forces behind the unemployment inflow and outflow rates.[1]

In this paper, we study the determinants of the inflow rate into and outflow rate from unemployment in 23 OECD countries using a Bayesian Model Averaging (BMA) approach to account for model uncertainty. We follow the theoretical and empirical literature on unemployment (Mortensen and Pissarides (1999), Pissarides (1998), Nickell, Nunziata, and Ochel (2005), Nunziata (2005), Blanchard and Wolfers (2000), Nickell (1997), Belot and Van Ours (2004), Nunziata (2003)) and consider a number of potential determinants from two broad categories: labor market institutions and indicators of macroeconomics shocks. Our results indicate the importance of labor market institutions for the inflow and outflow rates. In particular, public expenditures on passive labour market policies such as out-of-work income maintenance and support and early retirement constitute the main determinant of the unemployment outflow rate. An increase in such expenditures is associated with a decline in the outflow rate from unemployment. The main determinant of the inflow rate into unemployment is benefit duration. Longer benefit duration is positively related to the inflow rate into unemployment. Among macroeconomic shocks, the real interest rate and real import price shocks have an important impact on the outflow rate from unemployment.

2 Empirical framework

First, we estimate the inflow rate into and the outflow rate from unemployment, using the methodology developed by Shimer (2012) and Elsby et al. (2013). Second, we apply a BMA approach to identify the determinants of the inflow and the outflow rates.

[1]The exception is Murtin, De Serres, and Hijzen (2014) who studied how the coverage extension of collective wage agreements and the tax wedges affect the inflow and outflow rates using a sample of 15 countries over the period 1985-2007.

2.1 Inflow and Outflow Rates

The evolution of the unemployment rate, u_t, depends on the inflow and outflow rates as follows (see Shimer (2012) and Elsby et al. (2013)):

$$\frac{du_t}{dt} = s_t(1 - u_t) - f_t u_t, \tag{1}$$

where s_t is the monthly inflow rate into unemployment, f_t is the monthly outflow rate from unemployment, and t indexes months. Assuming that flow rates are constant within years and solving equation (1) forward one year, obtain:

$$u_t = \lambda_t u_t^* + (1 - \lambda_t) u_{t-12}, \tag{2}$$

where

$$u_t^* = \frac{s_t}{s_t + f_t} \tag{3}$$

denotes the flow steady-state unemployment rate, and

$$\lambda_t = 1 - e^{-12(s_t + f_t)}, \tag{4}$$

is the annual rate of convergence to steady state. In this way, we can relate variation in the unemployment stock u_t in a given country over a year to variation in the underlying flow rates, s_t and f_t.

Unemployment next month, u_{t+1}, is the sum of the number of unemployed workers this month who fail to find a job, $(1 - F_t)u_t$, and the number of newly unemployed workers, u_{t+1}^s:

$$u_{t+1} = (1 - F_t)u_t + u_{t+1}^s, \tag{5}$$

where u_{t+1}^s denotes the stock of unemployed workers with duration less than one month and reflects flow into unemployment; $F_t u_t$ reflects the flows out of unemployment. The probability that an unemployed worker exits unemployment within one month is

$$F_t = 1 - \frac{u_{t+1} - u_{t+1}^s}{u_t}. \tag{6}$$

The monthly outflow probability is related to the associated monthly outflow hazard rate, f_t, as follows:

$$f_t = -\ln(1 - F_t). \tag{7}$$

Once we compute the outflow rate f_t, we solve the equation (2) for the inflow rate, s_t, using a nonlinear solver.

As in Elsby et al. (2013) we use annual measures of the stock of unemployment with duration less than one month and quarterly measures of the aggregate unemployment from the OECD. The computed inflow and outflow rates are used as dependent variables in the empirical analysis described below.

2.2 Determinants

We follow related studies (Mortensen and Pissarides (1999), Pissarides (1998), Nickell et al. (2005), Nunziata (2005), Blanchard and Wolfers (2000), Nickell (1997), Belot and Van Ours (2004), Nunziata (2003)), and consider two broad categories of unemployment determinants: the characteristics of labour market institutions and the indicators of macroeconomics shocks to labour demand and supply. Below we describe each potential determinant in detail.

labour market institutions

- *Benefit level* (net benefit replacement rate) measured as the average net benefit rate (the percentage of the previous income) after tax at the first year of being unemployed for workers with a non-working spouse and no children. There is considerable empirical evidence that higher levels of unemployment benefits increase the unemployment duration (Nickell et al. (2005)). We ask whether such an increase is associated with any dynamics in the inflow into or outflow from unemployment.
- *Benefit duration*, an index that measures the relative level of unemployment benefit provided from the second to fifth year of being unemployed.[2] Empirical evidence suggests that shorter benefit entitlement leads to shorter unemployment duration (Nickell et al. (2005)). We examine how the unemployment flow rates are affected by benefit duration.
- *Expenditure on active labour market policies*, including job placement services, benefit administration, and labour market programmes such as training and job creation, as the share of GDP. Such expenditures can be efficient in reducing unemployment (Nickell et al. (2005)). Do they work through reducing the inflow or increasing the outflow rates?
- *Expenditure on passive labour market policies*, including out-of-work income maintenance and support and early retirement policies, as the share of GDP. Even though such expenditures can increase welfare of the recipients, they are likely to increase unemployment by lowering the incentives to work or to search for the job. Thus, such expenditures can potentially reduce the outflow rate from unemployment and increase the inflow rate into

[2]Formally, $BD = \frac{NRR_{>5}}{NRR_1}$, where BD is the index of Benefit Duration, NRR_1 is the net benefit replacement rate and $NRR_{>5}$ is the average net benefit replacement rate after the fifth year of unemployment.

unemployment.

- *Union density*, the fraction of employed workers who are reported as union members. This variable represents one aspect of the wage setting system and is likely to have a positive impact on unemployment. We analyze where its impact on unemployment works through the inflow or the outflow rates.
- *Employment protection*, an index that evaluates the strictness of employment protection legislation. Employment protection laws are thought to be a key factor in generating labour market inflexibility and, thus, increase unemployment (Nickell et al., 2005).
- *Wedge tax rate*, measured as the ratio of the amount of taxes paid by an average single worker without children and the corresponding total labour cost for the employer. The average tax wedge measures the extent to which tax on labour income discourages employment.

Macroeconomic shocks

- *labour demand shock*, computed as a residual from regressing total employment on real GDP, real labour cost per employee and lagged total employment, separately for each country. A positive shock to the labour demand is likely to decrease the equilibrium unemployment (Nickell et al. (2005)).
- *Real import price shock*, measured as the growth rate of real import prices times the import penetration. These shocks capture the effects of real wage resistance and are likely to affect positively the inflow rate into unemployment if real wages do not adjust (Grubb, Jackman, and Layard (1983)).
- *Real interest rate*, the difference between long-term interest rate on government bonds and the current rate of inflation, measured by the GDP Deflator. The real interest rate can affect capital accumulation and shift labour demand, if wages do not adjust (Blanchard and Wolfers (2000)).

Our data comprises 23 OECD countries over 2001–2013: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Japan, Luxembourg, Netherlands, Norway, Poland, Slovak Republic, Spain, Sweden, Switzerland, United Kingdom, United States. The sample period and the sample of countries are selected based on the availability of the above determinants. All the variables are obtained from the OECD database.

2.3 BMA Estimation

We identify the determinants of the unemployment outflow and inflow rates using a BMA approach to account for model uncertainty. Since there are different theories suggesting different potential determinants of unemployment, we are not certain about the true model specification governing the inflow and outflow rates from unemployment. The BMA approach allows us to deal with that uncertainty. To the best of our knowledge, this is the first study to address model uncertainty in the identification of the main drivers of inflows and outflows over time. We define the outflow model as follows:

$$f_{it} = \beta_0 + \mathbf{X}_{it}\beta + \mu_t + \mu_i + \varepsilon_{it}, \tag{8}$$

where f_{it} is the outflow rate from unemployment. We consider the same specification to estimate the inflow rate into unemployment, s_{it}. $\mathbf{X}_{it}$ denotes the potential determinants of the flow rate, μ_t are year dummies and capture time aggregate effects, μ_i is a country fixed effect and ε_{it} is the idiosyncratic time varying error. The BMA estimates models, M_j, for all possible combinations of the regressors, $j = 1, ..., 2^{10}$, and determines the models with the highest likelihood. The probability that M_j is the "true" model given the data, $\Pr(M_j|D)$, is the ratio of its marginal likelihood to the sum of marginal likelihoods over the entire model space:

$$\Pr(M_j|D) = \Pr(D|M_j)\Pr(M_j)/(\sum_{i=1}^{2^{10}} \Pr(D|M_i)\Pr(M_i)), \tag{9}$$

where

$$\Pr(D|M_j) = \int \Pr(D|\beta^j, M_j)\Pr(\beta^j|M_j)d\beta^j, \tag{10}$$

and β^j is the vector of parameters from model M_j, $Pr(\beta^j|M_j)$ is a prior probability distribution assigned to the parameters of model M_j, and $\Pr(M_j)$ is the prior probability that M_j is the true model. The posterior inclusion probability (PIP) is the probability that a particular variable h belongs to the true model:

$$\Pr(\beta_h \neq 0|D) = \sum_{j:\beta_h \in M_j, \beta_h \neq 0} \Pr(M_j|D). \tag{11}$$

The estimated posterior means and variance of $\hat{\beta} = (\hat{\beta}_1, ..., \hat{\beta}_{10})$ are constructed as

$$E(\hat{\beta}|D) = \sum_{i=1}^{2^{10}} \hat{\beta} \Pr(M_i|D), \tag{12}$$

$$Var(\hat{\beta}|D) = \sum_{i=1}^{2^{10}} (Var(\hat{\beta}|D, M_i) + \hat{\beta}^2) \Pr(M_i|D) - E(\hat{\beta}|D)^2. \tag{13}$$

For the implementation of the BMA methodology, we try a number of different priors on the parameter space and on the model space. We report the results for uniform prior on the model space and "BRIC" prior on the parameter space.[3] The results are robust to different priors.

We acknowledge the potential inefficiency of our estimates due to the measurement error being associated with the dependent variable. First, the two-state model described in section 2 ignore the fact that unemployed workers are less likely to leave the labour force and those outside the labour force are more likely to flow into unemployment during recessions. Elsby, Hobijn, and Şahin (2015) consider a three-state model by adding the flows involving inactivity (defined as neither employed nor unemployed) and show that these flows account for one-third of unemployment rates changes. We leave for future research the three state models due to data limitations. Besides, empirical evidence based on data from European countries suggests that accounting for the additional state of inactivity play little role in explaining unemployment changes in France Hairault et al. (2015) and Spain Silva and Vázquez-Grenno (2013) and most of our countries in the sample are from Europe. Second, our measure of the outflow probability may be affected by the temporal aggregation problem Shimer (2012), i.e. it misses multiple exits from unemployment within the period of the survey. However, the probability of multiple transitions is likely to be small since the inflow rate is very small in comparison to the outflow rate for most countries in our sample. Besides, temporal aggregation bias leads to an underestimation of the inflow and outflow rates, but this bias should not be systematically related to the determinants we consider in our main analysis.[4]

[3] See Ley and Steel (2009) for details on the model and parameter priors.

[4] Recently, Elsby et al. (2015) found, using the US monthly data, that ignoring temporal aggregation corrections lead to missing 30 percent of inflows into unemployment and 15 percent of outflows from unemployment. In contrast, Silva and Vázquez-Grenno (2013) showed, using Spanish data, that the flow rates estimated using the continuous time correction of Shimer (2012) were not statistically different from the flow rates estimated without the correction. In general, empirical research has shown that although the level of labour market mobility is affected by time aggregation bias, the cyclical features of labour markets remain relatively unchanged when accounting for time aggregation (Elsby, Michaels, and Solon (2009),Nekarda (2009)).

Table 1: Determinants of the outflow hazard rate from unemployment: BMA approach.

	PI prob.	Pt. Mean	Pt. Std.
Expenditure on passive policies	0.98	-0.291	0.091
Real interest rate shock	0.79	0.108	0.070
Real import price shock	0.75	-0.109	0.078
Labour demand shock	0.51	0.031	0.035
Expenditure on active policies	0.10	-0.009	0.038
Union density	0.18	-0.084	0.222
Wedge tax rate	0.09	-0.019	0.089
Employment protection	0.09	-0.015	0.075
Benefit duration	0.06	0.001	0.018
Benefit level	0.06	0.001	0.017

Column 1 presents the posterior inclusion probability. Column 2 shows the posterior mean. Column 3 reports the posterior standard deviation. The sample includes the following countries: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Japan, Luxembourg, Netherlands, Norway, Poland, Slovak Republic, Spain, Sweden, Switzerland, United Kingdom, United States, over 2001–2013. The dependent variable is the outflow hazard rate from unemployment. The results are obtained by using a uniform prior for the prior model probability and a BRIC prior for the hyperparameter that measures the degree of prior uncertainty on coefficients, $g = 1/max(N, K^2)$.

3 Results

We present in Table 1 and 2 the results of estimating using the BMA approach the determinants of the outflow rate and the inflow rate, respectively. Although we cannot claim any causal relationship between these determinants and the flow rates, because of potential reverse causality, we find that most of the determinants affect inflow and outflow rates of unemployment with the expected sign (see the posterior means in column 2 of Tables 1 and 2).

The results, presented in Table 1, suggest that the most robust determinant of the outflow rate from unemployment, f_t, is public expenditure on passive labour market policies. The probability that this variable belongs to the true model of the outflow rate is 0.98. The estimates imply that an increase in public expenditure on passive policies by one standard deviation is associated to a decrease of the outflow from unemployment by 0.29 standard deviations, which is roughly a 24% decline on the average outflow rate.

Passive policies, including unemployment benefits, can cause an increase in the reservation wages of unemployed workers, leading to a fall in the outflows from unemployment and lengthening the duration of unemployment (Atkinson and Micklewright (1991), Poterba and Summers (1995), Schmieder, Von Wachter, and Bender (2012)). Other determinants that are characterized by a relatively high probability of belonging to the true model of the outflow rate are real interest rate and real import price shocks, with a PIP of 0.79 and 0.75, respectively. A one standard deviation increase in long-run real interest rate is associated to a increase in the outflow rate

Table 2: Determinants of the inflow rate into unemployment: BMA approach.

	PI prob.	Pt. Mean	Pt. Std.
Benefit duration	0.93	0.265	0.109
Real import price shock	0.59	-0.089	0.087
Wedge tax	0.57	-0.329	0.334
Real interest rate shock	0.54	0.063	0.068
Labour demand shock	0.21	-0.010	0.024
Expenditure on passive policies	0.17	0.023	0.063
Benefit level	0.08	-0.005	0.030
Union density	0.07	0.008	0.102
Expenditure on active policies	0.06	-0.001	0.023
Employment protection	0.06	-0.001	0.057

Column 1 presents the posterior inclusion probability. Column 2 shows the posterior mean. Column 3 reports the posterior standard deviation. The sample includes the following countries: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Japan, Luxembourg, Netherlands, Norway, Poland, Slovak Republic, Spain, Sweden, Switzerland, United Kingdom, United States., over 2001–2013. The dependent variable is the inflow hazard rate to unemployment. The results are obtained by using a uniform prior for the prior model probability and a BRIC prior for the hyperparameter that measures the degree of prior uncertainty on coefficients, $g = 1/max(N, K^2)$.

of 0.11 standard deviations. A higher long-run real interest rate implies a higher cost of renting/buying capital. Our results show that the substitution effect of labour for capital dominates the negative scale effect driven by the higher production cost, leading to higher outflows from unemployment when the interest rate is higher. Real import price shocks are negatively related to the outflow rate. In particular, a one standard deviation increase in the real import price is related to a fall in the outflow rate from unemployment of 0.11 standard deviations.

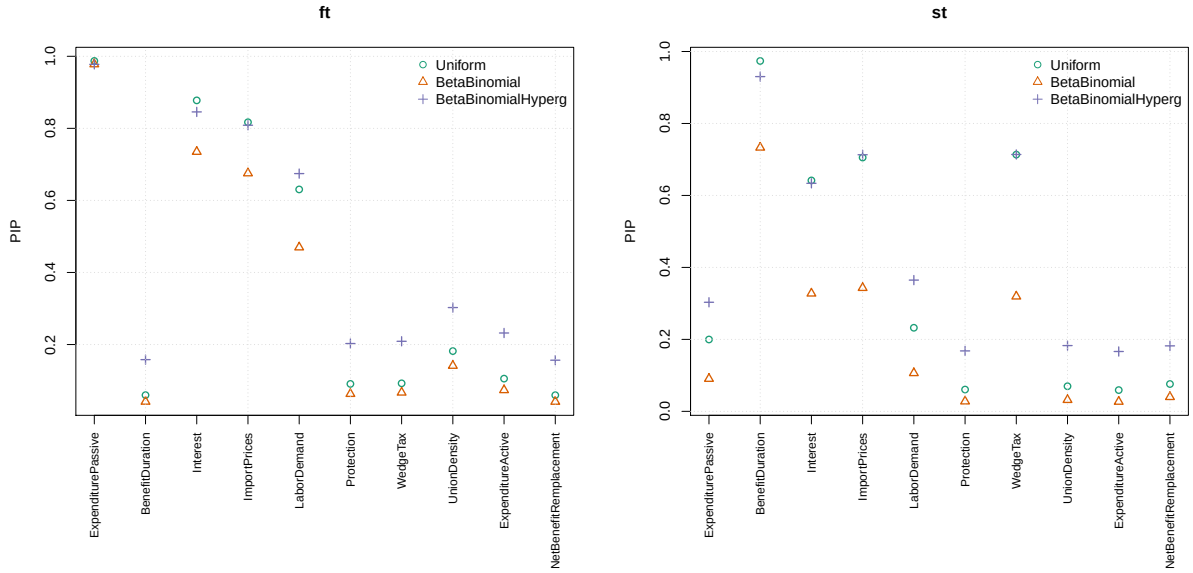
Table 2 reports the estimation results for the inflow rate into unemployment, s_{it}. The only robust determinant of the unemployment inflow rate is benefit duration. A one standard deviation in the unemployment benefit duration is related to 0.265 standard deviations increase in the inflow hazard rate. This finding is consistent with Tuit and van Ours (2010) who found that an increase in benefit duration leads to higher inflow rate into unemployment.

For robustness, we also consider a different model prior, beta-binomial prior, and two different priors on the parameter space, the unit information prior (UIP) and the hyper-g prior. The results, presented in Figure 1, suggest that the main findings are robust to the specification of the model and hyperparameter priors. The most robust determinants of the outflows and inflows to unemployment do not change with the change of the model or hyperparameter priors.[5]

These results should be interpreted with caution due to potential reverse causality issues. For example, during periods of long-term unemployment, characterized by high inflow rates to

[5]We also use an alternative approach to identify the most robust determinants: weighted average least squares. The results available upon request are qualitatively similar.

Figure 1: Determinants of unemployment inflow and outflow rates: PIP using different priors



unemployment, policymakers may react by increasing unemployment benefit duration. Thus, the estimated relationship does not necessarily imply a causal effect of benefit duration on inflow rate, but an association between these two variables.

4 Conclusion

We analyse robust determinants of the inflow rate into and the outflow rate from unemployment, using a BMA approach to account for model uncertainty. Our findings suggest that the most robust factors associated with the ins and outs from unemployment are related to the unemployment benefit system. Higher level of expenditure on passive labour market policies is negatively associated with the outflows from unemployment whereas the duration of benefit entitlement is positively related to the inflows into the unemployment pool.

References

Atkinson, A. B. and J. Micklewright (1991). Unemployment compensation and labor market transitions: a critical review. *Journal of economic literature 29*(4), 1679–1727.

Belot, M. and J. C. Van Ours (2004). Does the recent success of some oecd countries in lowering their unemployment rates lie in the clever design of their labor market reforms? *Oxford Economic Papers 56*(4), 621–642.

Blanchard, O. and J. Wolfers (2000). The role of shocks and institutions in the rise of european unemployment: the aggregate evidence. *The Economic Journal 110*(462), 1–33.

Elsby, M. W., B. Hobijn, and A. Şahin (2013). Unemployment dynamics in the oecd. *Review of Economics and Statistics 95*(2), 530–548.

Elsby, M. W., B. Hobijn, and A. Şahin (2015). On the importance of the participation margin for labor market fluctuations. *Journal of Monetary Economics 72*, 64–82.

Elsby, M. W., R. Michaels, and G. Solon (2009). The ins and outs of cyclical unemployment. *American Economic Journal: Macroeconomics 1*(1), 84–110.

Fujita, S. and G. Ramey (2009). The cyclicality of separation and job finding rates. *International Economic Review 50*(2), 415–430.

Gomes, P. (2012). Labour market flows: Facts from the united kingdom. *Labour Economics 19*(2), 165–175.

Grubb, D., R. Jackman, and R. Layard (1983). Wage rigidity and unemployment in oecd countries. *European Economic Review 21*(1-2), 11–39.

Hairault, J.-O., T. Le Barbanchon, and T. Sopraseuth (2015). The cyclicality of the separation and job finding rates in france. *European Economic Review 76*, 60–84.

Ley, E. and M. F. Steel (2009). On the effect of prior assumptions in bayesian model averaging with applications to growth regression. *Journal of applied econometrics 24*(4), 651–674.

Lin, C.-Y. and H. Miyamoto (2012). Gross worker flows and unemployment dynamics in japan. *Journal of the Japanese and International Economies 26*(1), 44–61.

Mortensen, D. T. and C. A. Pissarides (1999). New developments in models of search in the labor market. *Handbook of labor economics 3*, 2567–2627.

Murtin, F., A. De Serres, and A. Hijzen (2014). Unemployment and the coverage extension of collective wage agreements. *European Economic Review 71*, 52–66.

Nekarda, C. J. (2009). Understanding unemployment dynamics: the role of time aggregation. *Board of Governors of the Federal Reserve System Unpublished paper*.

Nickell, S. (1997). Unemployment and labor market rigidities: Europe versus north america. *Journal of Economic perspectives 11*(3), 55–74.

Nickell, S., L. Nunziata, and W. Ochel (2005). Unemployment in the oecd since the 1960s. what do we know? *The Economic Journal 115*(500), 1–27.

Nunziata, L. (2003). Labour market institutions and the cyclical dynamics of employment. *Labour Economics 10*(1), 31–53.

Nunziata, L. (2005). Institutions and wage determination: a multi-country approach. *Oxford Bulletin of Economics and Statistics 67*(4), 435–466.

Petrongolo, B. and C. A. Pissarides (2008). The ins and outs of european unemployment. *American economic review 98*(2), 256–62.

Pissarides, C. A. (1998). The impact of employment tax cuts on unemployment and wages; the role of unemployment benefits and tax structure. *European Economic Review 42*(1), 155–183.

Poterba, J. M. and L. H. Summers (1995). Unemployment benefits and labor market transitions: A multinomial logit model with errors in classification. *The Review of Economics and Statistics*, 207–216.

Rahn, D. and E. Weber (2017). Patterns of unemployment dynamics in germany. *Macroeconomic Dynamics*, 1–36.

Razzak, W. (2016). New zealand labor market dynamics: Pre-and post-global financial crisis. *Journal of Business Cycle Research 12*(1), 49–79.

Schmieder, J. F., T. Von Wachter, and S. Bender (2012). The effects of extended unemployment insurance over the business cycle: Evidence from regression discontinuity estimates over 20 years. *The Quarterly Journal of Economics 127*(2), 701–752.

Shimer, R. (2012). Reassessing the ins and outs of unemployment. *Review of Economic Dynamics 15*(2), 127–148.

Silva, J. I. and J. Vázquez-Grenno (2013). The ins and outs of unemployment in a two-tier labor market. *Labour Economics 24*, 161–169.

Smith, J. C. (2011). The ins and outs of uk unemployment. *The Economic Journal 121*(552), 402–444.

Tuit, S. and J. C. van Ours (2010). How changes in unemployment benefit duration affect the inflow into unemployment. *Economics Letters 109*(2), 105–107.

Yashiv, E. (2007). Us labor market dynamics revisited. *The Scandinavian Journal of Economics 109*(4), 779–806.